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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,124	02/06/2006	Miyuki Tsukioka	126928	2903
25944 7590 11/09/2010 OLIFF & BERRIDGE, PLC P.O. BOX 320850 ALEXANDRIA, VA 22320-4850				
EXAMINER				
CLARK, GREGORY D				
ART UNIT		PAPER NUMBER		
1786				
NOTIFICATION DATE		DELIVERY MODE		
11/09/2010		ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

OfficeAction25944@oliff.com  
jarnstrong@oliff.com

### Office Action Summary

**Application No.**

10/567,124

**Applicant(s)**

TSUKIOKA ET AL.

**Examiner**

GREGORY CLARK

**Art Unit**

1786

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 27 October 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,5-7,10 and 13 is/are pending in the application.
- 4a) Of the above claim(s) 3,4,8,9,11 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-7,10 and 13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

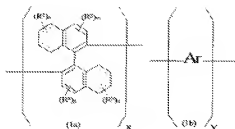
The examiner acknowledges the receipt of the applicants' amended claims/arguments remarks dated 10/13/2009.

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 1-2, 6-7, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu (Chemical Materials, Vol. 13, NO. 6, pages 1984-1991) in view of Chen (US 2004/0106003).**
2. **Regarding Claim 1**, applicant claims an electroluminescent polymer represented by Formula(s) 1a and 1b:



wherein:

$R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are each independently hydrogen, alkyl, alkenyl, alkynyl, aralkyl, aryl, heteroaryl, alkoxy, aryloxy, or aliphatic heterocyclic group;

the double bonds of the biphenyl structural unit indicated by dashed lines and solid lines are each an unsaturated double bond or a saturated single bond;

$m$  and  $p$  are each independently 0, 1, or 2;

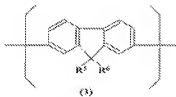
$n$  and  $o$  are each independently 0, 1, 2, 3, 4, 5, 6, 7, or 8;

when  $m$ ,  $n$ ,  $o$ , or  $p$  is an integer of 2 or greater, the two or more  $R^1$ 's,  $R^2$ 's,  $R^3$ 's, or  $R^4$ 's may or may not be identical to one another;

$x$  is the molar fraction of the biphenyl derivative structural units in a range of from 5 to 50 mol%;

$y$  is the molar fraction of the aryl structural units;

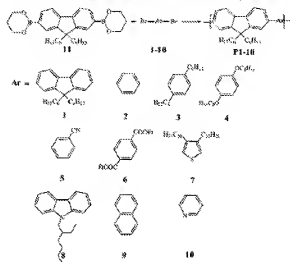
Ar is an aryl structural unit that can form an electroluminescent  $\pi$ -conjugated polymer, the aryl structural unit being a fluorene derivative structural unit represented by formula (3):



where  $R^5$  and  $R^6$  are each independently hydrogen, alkyl, alkenyl, alkynyl, aralkyl, aryl, heteroaryl, alkoxy, aryloxy, or aliphatic heterocyclic group.

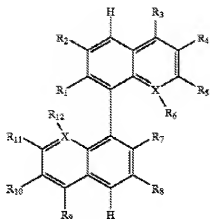
Liu discloses alternating polyfluorene copolymers with different main chain aromatic (phenylene) structures attached at the 2 and 5 positions synthesized by a

palladium-catalyzed Suzuki coupling reaction (abstract). Scheme 1 shows the synthetic route to the polymers:

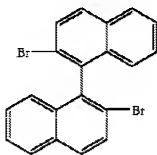
Scheme 1. Synthetic Route for the Polymers<sup>a</sup>

Liu further mentions that copolymerization of fluorene with various aryl partners allows for tunability of the electronic properties with enhanced stability (page 1985). Liu shows a number of reactive aromatic species (Br-Ar-Br) including naphthyl species 10 but fails to mention the binaphthylene species claimed by applicant.

Chen discloses a binaphthylene derivative that is reactive by a palladium-catalyzed Suzuki coupling reaction (paragraph 30) which is used to make electroluminescent compounds (paragraph 30) represented by Formula C-1 (paragraph 21):



wherein X can be a carbon atom; R6 and R12 can be substituted by aromatic compounds (paragraph 22). Formula C-1 as a reactive species can be represented by Formula C-2 (paragraph 44):



Chen further mentions that an advantage for using a binaphthylene derivative in and organic electroluminescent device (OLED) is that close molecular packing is prevented due to the large dihedral angle between the two naphthyl groups. When close molecular packing is prevented, the resulting OLED shows high photo and electro-luminescent efficiency.

Formula C-2 by Chen represents an aromatic dibromide species which is used in analogous manner to the of reactive aromatic species (Br-Ar-Br) of Liu (above). The

aromatic species (Br-Ar-Br) of Liu and Formula C-2 of Chen are components used to make materials used in OLED. As Liu teaches that incorporating dinaphthyl derivatives prevents close molecular packing resulting OLED shows high photo and electro-luminescent efficiency, one could envisage replacing a Br-Ar-Br species from Liu with Formula C-2 of Chen to make a polymer with improved photo and electro-luminescent efficiency.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have selected from known Suzuki reactive Br-Ar-Br species which would have included Formula C-2 of Liu which reads on the instant limitations since Liu teaches that incorporating dinaphthyl derivatives prevents close molecular packing resulting OLED shows high photo and electro-luminescent efficiency, absent unexpected results.

Liu and Chen fail to mention the molar fraction of the dinaphthyl derivative. Applicant claims 5-50 mol%.

As Chen teaches that the dinaphthyl derivative prevents close molecular packing resulting in an OLED that shows high photo and electro-luminescent efficiency, the molar fraction of the dinaphthyl derivative present in the copolymer is viewed as a cause effective variable to optimize the photo and electro-luminescent efficiency.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have adjusted the molar fraction of the dinaphthyl derivative to optimize the photo and electro-luminescent efficiency which would have included the claimed ranged, absent unexpected results.

3. **Regarding Claims 6-7, 10**, Chen in view of Liu teaches the invention of claims 1-2 and 4 (discussed above). Chen discloses an electroluminescent device containing a luminescent layer composed of a dinaphthyl derivative between two electrodes (paragraph 10) (per claims 6 and 10). Chen discloses that electroluminescent device can be used in a display (paragraph 4) (per claim 7).

4. **Claims 5 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu (Chemical Materials, Vol. 13, NO. 6, pages 1984-1991) in view of Chen (US 2004/0106003) as evidenced by Pielichowski (Progress in Polymer, 2003, Vol. 28, pages 1297-1353).**

5. **Regarding Claim 5**, Liu in view of Chen disclose the invention of claim 1.

Liu discloses that the electronic properties of the conjugated polymer is primarily governed by the chemical structure of the backbone itself. One way to achieve high efficiency in a polymer electroluminescent device (PLED) is to develop materials that have charge transporting properties (page 1985). Liu shows in Scheme 1(above) carbazole derivative 8 but fails to mention a terpolymer of identify carbazole derivative 8 as a charge transporting material.

Pielichowski discloses carbazole containing polymers as charge transporting materials (page 1298) used in a electroluminescent device (abstract).



As Liu mentions that the electronic properties of the conjugated polymer is primarily governed by the chemical structure of the backbone and show charge transporting carbazole derivative 8.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the electroluminescent copolymer of Liu in view of Chen by incorporating a third monomer which would have included the Suzuki carbazole 8 of Liu which read on the instant limitations since Liu teaches that higher efficiency in a polymer electroluminescent device (PLED) can be achieved with the copolymers also have charge transporting properties.

6. **Regarding Claim 13**, Liu in view of Chen and Pielichowski teaches the invention of claim 5 (discussed above). Chen discloses an electroluminescent device containing a luminescent layer composed of a dinaphthyl derivative between two electrodes (paragraph 10).

#### **Response to Arguments/Amendments**

Applicant argues that introducing binaphthyl derivative structural units into the backbone of an electroluminescent n-conjugated polymer, (i) bends can be introduced into the n-conjugated polymer, and (ii) despite the expectation that a polymer that has bends in it generally has a decreased glass transition point, the steric hindrance caused by the binaphthyl derivative structural units helps keep the glass transition point high and significantly stabilizes the morphology of the polymer.

The examiner counters that the binaphthyl derivative of Chen would inherently show a similar effect on the glass transition temperature. Chen discloses that the large dihedral angle between the naphthyl groups ensures a high degree of stereo-selectivity and results in non co-planer binaphthyl unit (paragraph 9). The examiner views the large dihedral angle between the naphthyl groups as equivalent to the applicants' "a polymer that has bends". Moreover, Chen discloses teaches that the binaphthyl unit is responsible for high photo and electro-luminescent efficiency. The glass transition temperature is viewed as an inherent physical property of a material which would be affected by the geometrical features of said material. As such, one would fully expect the binaphthyl unit of Chen to function in a similar capacity as applicant's binaphthyl unit, with respect to the glass transition temperature.

The applicant's arguments with respect to pending claims have been considered but are moot in view of the new grounds of rejection necessitated by the applicant's amendment.

### **Conclusion**

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GREGORY CLARK whose telephone number is (571)270-7087. The examiner can normally be reached on M-Th 7:00 AM to 5 PM Alternating Fri 7:30 AM to 4 PM and Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on (571) 272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/  
Supervisory Patent Examiner, Art Unit 1786

GREGORY CLARK/GDC/  
Examiner  
Art Unit 1786